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Original Article

INFLUENCE OF ORGANIC MANURE AND VARIOUS LEVEL OF NPK ON SOIL PHYSICO-CHEMICAL PROPERTIES OF MUSTARD (*BRASSICA JUNCEA* L.) cv. EURO SHAKTI

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ABSTRACT

An experiment was carried out at soil science research farm SHIATS, Allahabad during 2014-15. The experiment was laid out in randomized block design with 9 treatments in three replications on topic "Influence of organic manure and various level of NPK on soil physico-chemical properties of mustard crop". The Available nitrogen 321.33 kg ha^{-1}, phosphorus 29.00 kg ha^{-1}, and potassium 232.33 kg ha^{-1} was found respectively. It is concluded that treatment combinationT_8 (NPK @ 100% RDF + vermicompost @ 100% RD) and T_5 (NPK @ 50% RDF + vermicompost @ 100% RD)soil pH 7.00, bulk density 1.19 Mg m^{-3}, pore space 70.90%, organic carbon 0.79 %, T_5(NPK @ 50% RDF + vermicompost @100% RD), particle density 2.83 Mg m^{-3} and electrical conductivity 0.25 dSm^{-1} T_8 (NPK @ 100% RDF + vermicompost @ 100% RD) was found respectively. The maximum yield was recorded in T_5 (NPK @ 50% RDF + vermicompost @ 100% RD) 24.37 q ha^{-1} and maximum cost benefit ratio was recorded 1:2.30 with net return of ₹46,258.00 ha^{-1}.

KEYWORDS: Organic Manure, NPK, Soil Physico-chemical Properties, Mustard, etc

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INTRODUCTION

Indian mustard (*Brassica juncea* L.) commonly known as raya, rai or lahi is an important oilseed crop among the Brassica group of oilseed in India. It's the second most important edible oilseed crop in India after groundnut and accounts for nearly 30% of the total oilseeds produced in the country. Rapeseed-mustard is an important group of edible oil seed crops and contributes around 26.1% of the total oil seed production and contributes about 85% of the total rapeseed–mustard produced in India Meena *et al.* 2011. The first position in area and second position in production after China Anonymous 2009. Rape seed and mustard crops are cultivated in 53 countries across the globe covering an area of 24.2 million hectare. Indians contribution to world hectare and production is 28.3 and 19.8 percent respectively. Mustard is rich in minerals like calcium, manganese, copper, iron, selenium, zinc, vitamin A, B, C and proteins. 100g mustard seed contains 508 kcal energy, 28.09g carbohydrates, 26.08g proteins, 26.08 g total fat and 12.2g dietary fiber.(Anonymous, 2010)USDA Nutritive value of mustard seed. Nitrogen is the most important nutrient, which determines the growth of the mustard crop and increases the amount of protein and the yield. Phosphorus and potash are known to be efficiently utilized in the presence of nitrogen. It promotes flowering, setting of siliqua and in increase the size of siliqua and yield.

Phosphorus is an element for toria and mustard. Several scientists of the world have reported that the toria gives significant response of added phosphorus deficient soils. Phosphorus is generally deficient in majority of our Indian soils and need much attention for maintenance of soil fertility. Several experiments have been conducted under varying agro-climatic conditions by research of different countries. They have reported that phosphorus application in general had beneficial effect in imparting plant vagour and resistance of plants, against insect pest and disease, and increasing the vegetative growth and seed yield of toria and mustard. When phosphorus was applied in conjunction with nitrogen and potash, there was significant increase in the yield of toria and mustard.

Potassium is one of the seventeen elements which are essential for growth and development of plants. It's for improving the yield and quality of different crops because of its effect on photosynthesis, water use efficiency and plant tolerance to diseases, drought and cold as well for making the balance between protein and carbohydrates. (Singh*et al.*, 2010)

Vermicompost is a significant increase in total porosity and water holding capacity after addition of vermi compost to a greenhouse potting medium comprising a mixture of sand, pinebark and peat. Vermicompost may also have significant effects on soil physical properties. (Domínguez*et al.*, 2010)

MATERIALS AND METHODS

Experimental Details: Treatments and Design of Layout

The experiment was conducted at crop research farm department of Soil Science Allahabad School of Agriculture SHIATS Allahabad. The experimental site is located in the sub – tropical region with 25^0 27^1 N latitude 81^0 51^1 E longitudes and 98 meter the sea level altitudes in a Randomized Block Design (R.B.D.) with nine treatments, each consisting of three replicates. The total number of plots was 27. The Indian mustard (*Brassica Juncea* L.) cv. Euro Shakti' were sown in rabi season plots of size 2 x 2 m with row spacing 30 cm and plant to plant distance 15 cm. All the organic manure and various level of NPK under study were applied on field.

Soil Sampling

The soil of experimental area falls in order Inceptisol, alluvial in nature, both the mechanical and chemical analysis of soil was done before the starting the experiment to ascertain the initial fertility of the soil. The soil samples were randomly collected from0-15cm depths at randomly prior to tillage operations. The samples were mixed depth viz. and its weight was reducing by air drying, conning, quartering and passing it through 2mm sieve. To obtain composite soil sample in respective to different depth viz. the soil was stored for mechanical chemical analyze.

Physical and Chemical Analysis of Soil Samples

Table 1: Physical Analysis of Post Harvest Soil and Their Respective Methods

Particulars Method Employed Results	
Textural class	Sandy loam
Sand (%)	Bouyoucous Hydrometer60
Silt (%)	Method Bouyoucous (1927) 26
Clay (%)	14
Bulk density (Mg m-3)	Graduated measuring cylinder Black (1965)1.23
Particle density(Mg m-3)	Graduated measuring cylinder Black (1965) 2.32
Pore Space (%)	Graduated measuring cylinder Black (1965) 46.98

Table 2: Chemical Analysis of Post Harvest Soil and their Respective Methods

Particulars	Method Employed	Results
Soil pH (1:2) (Jackson, 1958)	Digital pH meter	7.18
Soil EC (dS m-1) (Wilcox, 1950)	EC meter (Digital Conductivity Meter)	0.19
Organic Carbon (%) (Walkley and Black's method 1947)		0.60
Available Nitrogen (kg ha-1) (Subbaih and Asija (1956)	Alkaline potassium permanganate method	290.26
Available Phosphorus (kg ha-1) (Olsen et al. 1954)	Colorimetric method	25.05
Available Potassium (kg ha-1) (Toth and Prince, 1949)	Flame photometric method	157.62

Table 3: Treatment Combination Used for Experimental Trial

S. No.	Symbol	Description
1	$T_0(L_0+V_0)$	Control
2	$T_1(L_0+V_1)$	NPK@0%+vermicompost@50%
3	$T_2(L_0+V_2)$	NPK@0%+vermicompost@100%
4	$T_3(L_1+V_0)$	NPK@50%+vermicompost@0%
5	$T_4(L_1+V_1)$	NPK@50%+vermicompost@50%
6	$T_5(L_1+V_2)$	NPK@50%+vermicompost@100%
7	$T_6(L_2+V_0)$	NPK@100%+vermicompost@0%
8	$T_7(L_2+V_1)$	NPK@100%+vermicompost@50%
9	$T_8(L_2+V_2)$	NPK@100%+vermicompost@100%

Dose of Fertilizer, Organic Manure and NPK Used

0 % NPK = @N 0 kg ha^{-1}, P 0 kg ha^{-1}, K 0 kg ha^{-1}

50% NPK = @N 40 kg ha^{-1}, P 30 kg ha^{-1}, K 20 kg ha^{-1}

100 % NPK = @N 80 kg ha^{-1}, P 60 kg ha^{-1}, K 40 kg ha^{-1}

[(100 % N:P:K = 80:60:40 kg) RDF ha^{-1}]

0% [Vermicompost] = Vermicompost @0.00 t ha^{-1}

50% [Vermicompost] = Vermicompost@2.5 t ha^{-1}

100% [Vermicompost] = Vermicompost@5 t ha^{-1}

Table 4: Details of Organic Manure and Inorganic Fertilizers given at the Time of Sowing Plot

Treatment	Dose(Kg Ha^{-1})	Source (%)	Quantity Applied / Plot ($4m^2$)
Nitrogen	40 kg N ha^{-1} 80 kg N ha^{-1}	Urea (46%N) Urea (46%N)	34.78 g/plot 69.56 g/plot
Phosphorus	30 kg P ha^{-1} 60 kg P ha^{-1}	SSP (16%P_2O_5) SSP (16%P_2O_5)	75 g /plot 150 g/ plot
Potassium	20 kg Kha^{-1} 40 kg Kha^{-1}	MOP(60%K_2O) MOP(60%K_2O)	13g/ plot 26g/plot
Vermicompost	2.5 t ha^{-1} 5 t ha^{-1}	Nitrogen (1.20%) Phosphorus (1.80 %) Potassium (0.50%)	4kg/ plot 8 kg/ plot

Sourse: Modern techniques raising field crops (Singh *et al.* 2012)

RESULTS AND DISCUSSIONS

Physical Properties

Response on bulk density, particle density and percentage pore space of soil after crop harvest.

As depicted in table 5 shows that the maximum Db of soil (Mg m^{-3}), was found in T_5 (NPK@50% RDF +vermicompost@100% RD) 1.19 g cm^{-3} followed by T_1 (NPK@0% RDF+vermicompost@50% RD) 1.11 g m^{-3}. The influence of organic manure and various level of N,P&K on Db (g m^{-3}) of soil were found significant. The result shows that the maximum Dp of soil was found in T_5 (NPK@50% RDF +vermicompost@100% RD) 2.83g m^{-3} followed by T_8 (NPK@100%RDF +vermicompost@100% RD) 1.87 g m^{-3}. The influence of organic manure and various level of NPK on Dp of soil were found significant. The maximum pore space (%) of soil was found in T_5 (NPK@50%+vermicompost@100%) 70.90% followed by T_0 (NPK@0%+vermicompost@0%) which was 60.50%. The influence of organic manure and various level of NPK on percentage pore space of soil were found significant. The result are conformity with the finding of Singh *et al.*(2012).

Table 5: Influence of Organic Manure and Various Level of NPK on Soil Physico-Chemical Properties of Mustard

Treatment	Soil pH	EC (dSm^{-1})	Soil Bulk Density (g cm^{-3})	Soil particale density (g cm^{-3})	Soil pore space (%)	OC	Available Nitrogen (Kg ha^{-1})	Available phosphorous (Kg ha^{-1})	Available Potassium (Kg ha^{-1})
T_0	7.67	0.29	1.17	1.95	60.50	0.61	287.33	18.68	153.00
T_1	7.40	0.21	1.11	2.53	61.67	0.68	297.33	23.30	168.33
T_2	7.50	0.21	1.14	2.44	62.67	0.72	301.67	22.33	193.33
T_3	7.57	0.22	1.15	2.28	64.67	0.63	307.67	21.33	178.33
T_4	7.07	0.20	1.13	2.51	63.73	0.71	312.67	24.68	208.67
T_5	7.00	0.23	1.19	2.83	70.90	0.79	320.67	25.33	215.33
T_6	7.57	0.21	1.15	2.28	65.43	0.66	305.67	23.68	200.68
T_7	7.30	0.24	1.16	2.07	67.17	0.79	314.67	27.68	224.00
T_8	7.12	0.25	1.18	1.87	68.67	0.77	321.33	29.00	232.33
F-test	S	S	S	S	S	S	S	S	S
S.Ed. (±)	0.16	0.02	0.06	0.08	2.55	0.04	9.04	1.65	16.83
C.D. (at 5%)	0.35	0.05	0.13	0.17	5.41	0.09	19.17	3.49	35.69

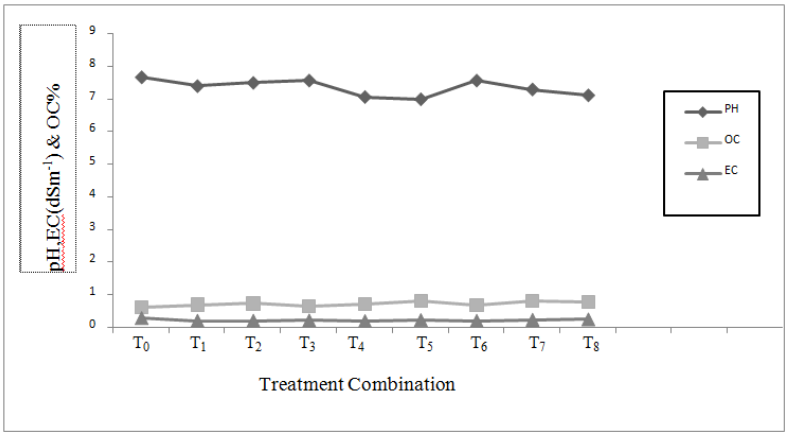

Figure 1: Influence of Organic Manure and Various Level of NPK on Soil pH, EC and %OC after Harvest Mustard (*Brassica juncea* L.)

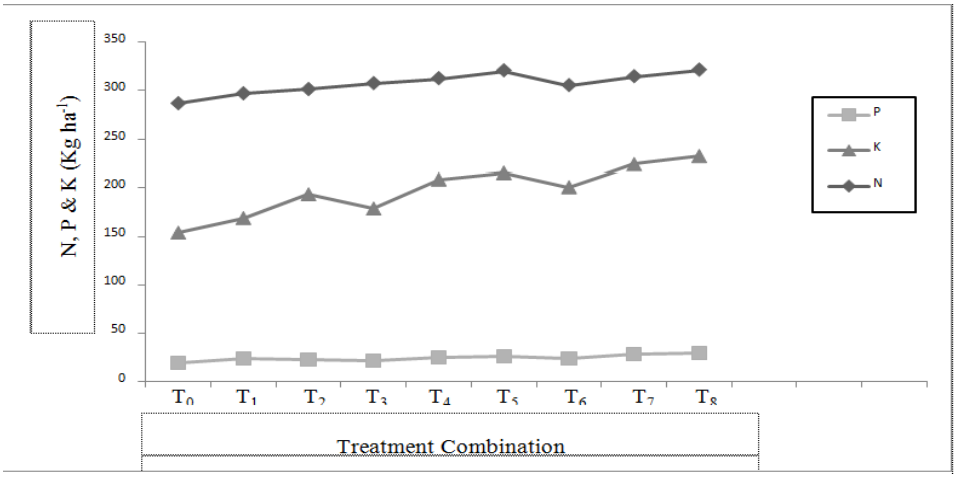

Figure 2: Influence of Organic Manure and Various Level of NPK on Soil NPK after Harvest Mustard (*Brassica juncea* L.)

Chemical Properties

Response on pH and EC at 25^0 C (dSm^{-1}) of soil after crop harvest.

As depicted in table 5 shows that the pH and EC at 25^0 C (dSm^{-1}) of soil was found in T_0 (control) 7.69 and 0.29 followed by T_5 (NPK@50% RDF +vermicompost@100%RD) and T_4 (NPK@50% RDF+vermicompost@50% RD) 7.00 and 0.20. The influence of organic manure and various level of NPK on pH and EC was found significant. Response of organic carbon (%), available nitrogen, phosphorus, potassium (kg ha^{-1}) of soil after crop harvest.

As depicted in table 5 shows that the maximum % OC of soil was found in T_5 (NPK@50% RDF+vermicompost@100% RD) 0.79 followed by T_0 (Control) 0.61. The influence of organic manure and various level of NPK on % OC of soil was found significant. The available nitrogen, phosphorus and potassium (kg ha^{-1}) in soil were found maximum in T_8 (NPK@100% RDF+vermicompost@100% RD) 321.33, 29.00, 232.33 kg ha^{-1} was found respectively followed byT_0 (control) which were 287.33, 18.68, 153.00 kg ha^{-1} found respectively. The influence of organic manure and various level of NPK on available nitrogen, phosphorus and potassium was found significant. The results are conformity with the finding of Ram Bharose *et al.* 2011.

CONCLUSIONS

It is concluded from the experiment that treatment combination T_5(NPK @ 50% RDF + vermicompost @ 100% RD) gave best results for soil pH 7.00, electrical conductivity 0.29 dSm^{-1} (T_0), bulk density 1.19 mg m^{-3}, particle density 2.53 mg m^{-3} (T_1), pore space 70.90%, organic carbon 0.79 % and T_8(NPK @ 100% RDF + vermicompost @ 100% RD) available nitrogen 321.33 kg ha^{-1}, phosphorus 29.00 kg ha^{-1}, potassium 232.33 kg ha^{-1} respectively. Soil chemical properties as available NPK, pH, EC, OC (%) and soil physical properties as particle density (g m^{-3}), percent pore space (%) and bulk density (g m^{-3}) was found to be significant. The maximum yield was recorded in T_5 (NPK @ 50%+ vermicompost @100%) and maximum cost benefit ratio was 1:2.30 with net return of ₹46,258.00 ha^{-1}. The maximum NPK was recorded to T_8 (NPK @ 100%+ vermicompost @ 100%) followed by T_0 (Control).

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